General

Guideline Title

Prevention of ventilator-associated pneumonia. Health care protocol.

Bibliographic Source(s)

Institute for Clinical Systems Improvement (ICSI). Prevention of ventilator-associated pneumonia. Health care protocol. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2011 Nov. 29 p. [39 references]

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Note from the National Guideline Clearinghouse (NGC) and the Institute for Clinical Systems Improvement (ICSI): For a description of what has changed since the previous version of this guidance, refer to Summary of Changes Report--November 2011 . This document has been converted from an Order Set to a Protocol that includes an order set.

The recommendations for prevention of ventilator-associated pneumonia are presented in the form of a protocol and annotation table with two components accompanied by detailed annotations. The protocol and annotation table are provided in the original guideline document at the ICSI Web site. Clinical highlights and the annotations follow.

Class of evidence (A-D, M, R, X) ratings are defined at the end of the "Major Recommendations" field.

Clinical Highlights

- Reliably implement the ventilator bundle (set of interventions). *(Introduction; see the original guideline document)*

Prevention of Ventilator-associated Pneumonia Annotations

1. Nursing and Respiratory Care
   Head of Bed

   In the absence of medical contraindications, elevate the head of the bed at an angle of 30-45 degrees for a patient at high risk for aspiration (e.g., a person receiving mechanically assisted ventilation and/or who has an enteral tube in place) *[R]*, *[A]*.

   Maintaining the head of the bed at greater than 30 degrees may be difficult. Lower elevations (20-30 degrees) may not prevent ventilator-

associated pneumonia compared to a "control" elevation of 10 degrees *[A]*.

Cuff Pressure

Cuff pressure should be maintained at 20-25 cm H_2O. Minimal leak technique is discouraged *[R]*, *[B]*. A group of researchers noted that low intracuff pressure may be a risk factor for ventilator-associated pneumonia. Their data demonstrated a benefit for maintaining cuff pressure in the endotracheal tube above 20 mm Hg. As a secondary outcome to this study of continuous aspiration of subglottic secretions, low cuff pressures were associated with a higher risk of ventilator-associated pneumonia for patients not receiving antibiotics *[B]*.

In a review article it is noted that "stagnant oropharyngeal secretions above the cuff can easily gain access to the lower airway when cuff pressure decreases spontaneously or there is a temporary deflation of the cuff" *[R]*. An earlier study of cuff pressures found that pooled secretions above the inflated endotracheal cuff may be a source of aspiration and a cause of ventilator-associated pneumonia *[NA]*.

The Centers for Disease Control and Prevention does not currently have recommendations for endotracheal cuff pressures.

Circuit Change

Less frequent changes do not lead to increased incidence of ventilator-associated pneumonia. Circuit changes should occur when visibly soiled rather than routinely *[R]*.

Heated Humidifiers, and Heat and Moisture Exchangers

The Centers for Disease Control and Prevention makes no preferential recommendation regarding the use of heated humidifiers or heat and moisture exchangers.

There is insufficient evidence to conclude that the ventilator-associated pneumonia rate differs in patients ventilated with heated humidifiers compared to heat and moisture exchangers, especially if double-heater-wire circuit technology is used in the latter *[A]*.

The Centers for Disease Control and Prevention recommends that heat and moisture exchangers not be changed more frequently than every 48 hours or when they become visibly soiled or mechanically malfunction *[R]*. In studies where the heat and moisture exchangers were changed either every 48 hours or up to 120 hours as compared to every 24 hours, no increase in ventilator-associated pneumonia was identified. In addition, no differences in technical or clinical performance of the ventilators were identified *[A]*.

In a prospective, randomized, non-blinded trial of 155 consecutive patients in a community intensive care unit requiring mechanical ventilation for more than 48 hours, no differences in ventilator-associated pneumonia, bacterial colonization or ventilator support variables were found when comparing heat and moisture exchangers changes after one day or after up to seven days *[A]*.

In addition, it was found that endotracheal tube occlusion is a very rare event when humidification is provided by extended (up to seven days) use of heat and moisture exchangers. This was probably attributed to several key points:

- Patients with contraindications (hypothermia, bronchopleural fistulas) must be excluded.
- Tube patency must be checked by regular suctioning.
- Heat and moisture exchangers must be changed when they are visibly soiled.
- Heat and moisture exchangers should be placed vertically above the tracheal tube, and nurses and doctors should repeatedly check the position.

Because these studies were conducted on adult populations in an intensive care unit setting, other studies are required to determine the safety of extended heat and moisture exchangers use in other populations such as pediatric patients and long-term ventilator-dependent patients.

Oral Care

A randomized controlled trial and a meta-analysis evaluated the effectiveness of oral decontamination with a 2% chlorhexidine solution for the prevention of ventilator-associated pneumonia. The patient received a 2% chlorhexidine solution or normal saline solution four times per day until endotracheal tube removal. The incidence of ventilator-associated pneumonia, oropharyngeal colonization with gram negative bacilli and overall mortality showed no difference. However, the number of episodes of ventilator-associated pneumonia per 1,000 ventilator days was statistically different between the chlorhexidine and normal saline groups. Irritation of the oral mucous was noted at a higher rate in the chlorhexidine group and was a dose limiting effect.

This study was combined with one other randomized, controlled trial for a meta-analysis that evaluated oral contamination with 2% chlorhexidine and the incidence of pneumonia in mechanically ventilated patients. There was a significant reduction in the rate of ventilator-

associated pneumonia in the chlorhexidine group *[A]*.

Secretion Removal with Specially Designed Endotracheal Tubes

The American Thoracic Society document recommends continuous aspiration of subglottic secretions; the use of a specially designed endotracheal tube has significantly reduced the incidence of early-onset ventilator-associated pneumonia in several studies *[R]*.

Due to the risk of the high aspiration of subglottic secretions during an endotracheal tube switch, changing out a standard endotracheal tube for an endotracheal tube with a subglottic suction lumen is not recommended.

The Centers for Disease Control and Prevention states that if feasible, use an endotracheal tube with a dorsal lumen above the endotracheal cuff to allow drainage (by continuous or frequent intermittent suctioning) of tracheal secretions that accumulate in the patient's subglottic area *[R]*. Before deflating the cuff or removing the tube for endotracheal tubes without a dorsal lumen, ensure that secretions are cleared from above the tube cuff.

Intubated patients managed with an endotracheal tube with a subglottic secretion removal port have lower rates of ventilator-associated pneumonia and, for patients expected to require more than 72 hours of ventilation, these special endotracheal tubes can reduce duration of mechanical ventilation. Since they are inserted prior to the start of mechanical ventilation, their use lies beyond the scope of a protocol for intubated patients. However, the work group recommends their use in the context of a hospital wide program to identify patients expected to require prolonged mechanical ventilation (usually patients requiring emergency intubation) and to have the special tubes available to the emergency department (ED) and clinicians who perform emergency intubations for hospitalized patients.

Closed, In-Line Suctioning

This work group concludes that the evidence on closed, in-line suctioning is varied; therefore, at this time it will not be included in the protocol. One study supports the view that application within 72 hours significantly enhances the microbial growth in the lower respiratory tract. Normal saline instilled with endotracheal suctioning may lead to dispersion of microorganisms into the lower respiratory tract. However, when using closed systems, the exposure to hospital personnel is significantly decreased *[A]*.

The Centers for Disease Control and Prevention makes no preferential recommendation for use of either the multi-use closed suction system or the single-use open suction system *[R]*. Other researchers could not demonstrate a decrease of ventilator-associated pneumonias in either closed in-line suction systems or open systems *[A]*.

A meta-analysis of 15 randomized trials showed no significant difference in incidences of ventilator-associated pneumonia and mortality comparing closed suction system to open suction system. No conclusions could be drawn with respect to arterial oxygen saturation, arterial oxygen tension, and secretion removal *[M]*.

Kinetic Bed Therapy

In 2004, a prospective, randomized, multicenter study found that kinetic bed therapy significantly decreased the occurrence of ventilator-associated pneumonia and lobar atelectasis *[A]*.

Kinetic bed therapy (continuous lateral rotation) can reduce the incidence of ventilator-associated pneumonia but it does not seem to reduce other important outcomes such as mortality or ventilation duration. Because it requires a special bed that may not be available to all intensive care units (ICUs), the work group does not make a strong recommendation that it be used routinely in ventilated patients.

Sedation Reduction

Regular testing of the patient's ability to sustain adequate ventilation, oxygenation and breathing comfort (e.g., spontaneous breathing trial) has been shown to significantly reduce duration of mechanical ventilation for acute respiratory failure.

Daily cessation (after the second day of intubation) of continuous infusions of sedative medications decreases the duration of mechanical ventilation and decreases diagnostic testing to evaluate impaired mental status that occurs after intensive care admission *[A]*. Use of a sedation algorithm that frequently adjusts sedative and analgesics doses to promote tolerance of the intensive care unit environment while maintaining wakefulness was also shown to reduce the duration of mechanical ventilation *[C]*.

Individual intensive care units can modify the above research protocols for local circumstances, but essential elements of these protocols include regular patient assessment by a sedation scale, daily dose cessation or hourly dose reduction if patients are considered oversedated, use of opiates as a co-sedative if pain is likely, and use of bolus therapy to achieve adequate sedation before increasing the continuous infusion rate. The main contraindication to sedative cessation is neuromuscular blockade, and severe respiratory failure and life-support

withdrawal are relative contraindications.

Weaning Readiness

Daily (or more frequently), brief weaning trials allow early assessment of patients' ability to sustain ventilation, oxygenation, breathing comfort and hemodynamic stability. Studies have shown that respiratory therapist or nurse-driven protocols that communicate to physicians the patient's tolerance and physiological response to 30-60 minutes of unsupported (e.g., continuous positive airway pressure [CPAP] or t-piece) or minimally supported breathing (e.g., pressure support of 7 cm H_2O) leads to decreased duration of mechanical ventilation. Clinical judgment is necessary in the decision to extubate patients, incorporating the results of the weaning trial but also the patient's level of consciousness, airway stability, illness course and hemodynamic status. There are numerous reasons to temporarily postpone daily weaning trials: increased intracranial pressure, severe respiratory failure such as FiO_2 greater than 50%, positive end-expiratory pressure greater than or equal to eight or prone positioning, unstable airway or hemodynamics, neuromuscular blockade, apnea, or anticipated life support withdrawal *[R]*, *[A]*.

Combining daily sedation cessation followed by a spontaneous breathing trial is more effective than performing daily spontaneous breathing trials alone. Combining the two interventions may decrease intensive care unit length of stay by three days; it increases ventilator-free days (alive and breathing unassisted during the 28-day interval after intubation) and decreases the duration that patients are comatose *[A]*.

2. Medications
   Stress Ulcer Prophylaxis

The Centers for Disease Control and Prevention make no recommendation for the preferential use of sucralfate, H2-antagonists, and/or antacids for stress-bleeding prophylaxis in patients receiving mechanically assisted ventilation. Stress ulcer prophylaxis is used clinically in various strategies of prevention in the critical, intensive care patient. The recommendation of a particular regimen will, in part, depend upon which primary outcome a provider is focusing his/her efforts of prevention.

One study showed that there is convincing evidence to suggest interventions can be employed to prevent hospital-acquired pneumonia or ventilator-associated pneumonia. The evidence-based interventions focus on the prevention of aerodigestive tract colonization (avoidance of unnecessary antibiotics and stress ulcer prophylaxis, use of sucralfate for stress ulcer prophylaxis, selective digestive decontamination, short-course parenteral prophylaxis in high-risk patients) *[R]*.

A randomized clinical controlled study on 52 patients in an intensive care unit demonstrated that the incidence of upper gastrointestinal bleeding was similar in the ranitidine and sucralfate groups, higher in the control. The mean gastric pH was higher with ranitidine. The incidence of positive cultures with gram-negative organisms was significantly higher in the ranitidine group (75% compared to 33% with sucralfate). The incidence of positive growth in the bronchoalveolar lavage (BAL) culture was similar in all three groups *[A]*.

Assess the need for ongoing stress ulcer prophylaxis. Discontinuation of prophylaxis should be considered if the patient is extubated, if there is no significant gastrointestinal bleeding upon transfer out of the intensive care unit, traumatic brain or spinal cord injury does not exist, if the patient is receiving enteral feeds, if the patient is not on a high-dose of glucocorticoid therapy and/or is not on an outpatient medication *[C]*.

Venous Thromboembolism Prophylaxis

Venous thromboembolism prophylaxis is recommended for most patients in the intensive care unit or with risk factors for venous thromboembolism. One study reviewed prevention of thromboembolism for a wide range of clinical conditions *[R]*. The following statements can be made based on the evidence presented in this reference.

General Venous Thromboembolism Recommendations

- The rationale for the use of thromboprophylaxis is based on solid principles and scientific evidence. Most hospitalized patients have one or more risk factors for venous thromboembolism, and the risk factors are generally cumulative.
- There is a strong association between asymptomatic deep venous thrombosis and the subsequent development of symptomatic venous thromboembolism.
- The prevention of fatal (or any) pulmonary embolus is the top priority, and this outcome is uncommon. The prevention of symptomatic deep venous thrombosis and pulmonary embolus is important since these occurrences are associated with considerable acute mortality, substantial costs and long-term sequelae.
- Mechanical methods of prophylaxis should be considered for all patients with high bleeding risks. Pneumatic compression devices increase venous outflow and/or reduce stasis within the leg veins. These mechanical methods have been shown to reduce the risk of deep venous thrombosis in a number of patient groups. However, they have not been shown to reduce the risk of death or pulmonary

embolus. The use of these devices (when used properly) is an acceptable option in certain patient groups, especially in those patients at high risk for bleeding complications, or when used in combination with anticoagulant prophylaxis.

- It is recommended that on admission to a critical care unit, all patients be assessed for their risk of venous thromboembolism, and that accordingly, most patients should receive thromboprophylaxis.

Specific Venous Thromboembolism Prophylaxis Recommendations for Intensive Care Unit Patients

Intensive care unit patients are at high risk for deep vein thrombosis and pulmonary embolism but also for bleeding, thrombocytopenia coagulopathy and renal impairment. During an intensive care unit stay, different types of thromboprophylaxis might be appropriate at different times, including, at times, combined therapies of an anticoagulant medication (heparins or fondaparinux) and intermittent compression devices.

For more information, see the NGC summaries of the ICSI guidelines Venous Thromboembolism Prophylaxis and Antithrombotic Therapy Supplement.

Definitions:

Classes of Research Reports

Class	Description
Primary Reports of New Data Collections	
A	Randomized, controlled trial
B	Cohort-study
C	Non-randomized trial with concurrent or historical controls • Case-control study • Study of sensitivity and specificity of a diagnostic test • Population-based descriptive study
D	Cross-sectional study • Case series • Case report
Reports that Synthesize or Reflect upon Collections of Primary Reports	
M	Meta-analysis • Systematic review • Decision analysis • Cost-effectiveness analysis
R	Consensus statement • Consensus report • Narrative review
X	Medical opinion

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

- Ventilator-associated pneumonia
- Other complications (e.g., stress ulcer, venous thromboembolism) in patients on ventilators

Note: This protocol does not include admission orders to the intensive care unit or other specific orders for the patient's condition outside of ventilator management.

Guideline Category

Management

Prevention

Risk Assessment

Clinical Specialty

Critical Care

Emergency Medicine

Internal Medicine

Nursing

Preventive Medicine

Pulmonary Medicine

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Emergency Medical Technicians/Paramedics

Health Care Providers

Health Plans

Hospitals

Managed Care Organizations

Nurses

Physician Assistants

Physicians

Respiratory Care Practitioners

Guideline Objective(s)

- To eliminate ventilator-associated pneumonia in adult patients in an intensive care unit
- To increase the use of ventilator-associated pneumonia bundle in all ventilated patients in an intensive care unit

Target Population

Adult patients on ventilators in the intensive care unit

Interventions and Practices Considered

1. Elevation of the head of the bed
2. Maintaining cuff pressure in the endotracheal tube between 20-25 mmHg
3. Circuit changes
4. Use of heated humidifiers and heat and moisture exchangers
5. Providing oral care with chlorhexidine and water-soluble mouth moisturizer
6. Secretion removal with specially designed endotracheal tubes
7. Closed, in-line suctioning (no recommendation made)
8. Evaluation for kinetic bed therapy
9. Sedation reduction
10. Assessment of weaning readiness with brief weaning trials
11. Stress ulcer disease prophylaxis
12. Deep vein thrombosis prophylaxis

Major Outcomes Considered

Effectiveness of ventilator bundle interventions in preventing ventilator-associated pneumonia and deaths from ventilator-associated pneumonia

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

A consistent and defined process is used for literature search and review for the development and revision of Institute for Clinical Systems Improvement (ICSI) Protocols. The PubMed and Cochrane databases were searched from January 2009 through June 2010 and focused on clinical trials, meta-analyses and systematic reviews. Literature search terms included probiotics, VAP, ventilator-associated pneumonia. No further limitations were made in the search.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Classes of Research Reports

Class	Description
Primary Reports of New Data Collections	
A	Randomized, controlled trial
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Reports that Synthesize or Reflect upon Collections of Primary Reports	
M	Meta-analysis • Systematic review • Decision analysis • Cost-effectiveness analysis
R	Consensus statement • Consensus report • Narrative review
X	Medical opinion

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review

Description of the Methods Used to Analyze the Evidence

Not stated

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Document Development

A work group consisting of 6 to 12 members that includes physicians, nurses, pharmacists, other healthcare professionals relevant to the topic, and an Institute for Clinical Systems Improvement (ICSI) staff facilitator develops each document. Ordinarily, one of the physicians will be the leader. Most work group members are recruited from ICSI member organizations, but if there is expertise not represented by ICSI members, 1 or 2

members may be recruited from medical groups, hospitals or other organizations that are not members of ICSI.

The work group will meet for 3 to 4 three-hour meetings to develop the protocol. Under the coordination of the ICSI staff facilitator, the work group develops the algorithm and writes the annotations and literature citations. The literature is graded in the document based on the ICSI Evidence Grading System.

Once the final draft copy of the protocol is developed, the document is sent to the ICSI members for review and comment.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Review and Comment

The purpose of the review and comment process is to provide an opportunity for the clinicians in the member organizations to review the science behind the recommendations and focus on the content of the protocol. Review and comment also provide an opportunity for clinicians in each organization to come to consensus on feedback they wish to give the work group and to consider changes needed across systems in their organization to implement the protocol.

All member organizations are encouraged to provide feedback on protocols; however, responding to review and comment is not a criterion for continued membership within the Institute for Clinical Systems Improvement (ICSI).

Document Approval

Each protocol is approved by the appropriate steering committee. There is a steering committee for Respiratory, Cardiovascular, Women's Health, and Preventive Services. The Committee for Evidence-based Practice approves guidelines, order sets, and protocols not associated with a particular category. The steering committees review and approve each guideline based on:

- Member comments have been addressed reasonably.
- There is sufficient reason to expect that members will use the protocol with minor modifications or adaptations.
- Within the knowledge of the reviewer, the recommendations in the protocol are consistent with other protocols, regulatory and safety requirements, or recognized authorities.
- When evidence for a particular step in the protocol has not been established, the work group identifies consensus statements that were developed based on community standard of practice and work group expert opinion.
- Either a review and comment by members has been carried out, or within the knowledge of the reviewer, the changes proposed are sufficiently familiar and sufficiently agreed upon by the users that a new round of critical review is not needed.

Once final draft copy of the protocol is developed, the document is sent to the ICSI members for review and comment.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is classified for selected recommendations (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Increased use of ventilator-associated pneumonia bundle in all ventilated patients in an intensive care unit
- Elimination of ventilator-associated pneumonia in adult patients in an intensive care unit

Potential Harms

Chlorhexidine at a higher rate is associated with irritation of the oral mucus and is a dose limiting effect.

Contraindications

Contraindications

The main contraindication to sedative cessation is neuromuscular blockade; severe respiratory failure and life-support withdrawal are relative contraindications.

Qualifying Statements

Qualifying Statements

- This Institute for Clinical System Improvements (ICSI) health care protocol is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition. An ICSI health care protocol will rarely establish the only approach to a problem.
- This health care protocol should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients are urged to consult a health care professional regarding their own situation and any specific medical questions they may have.

Implementation of the Guideline

Description of Implementation Strategy

Once a guideline is approved for release, a member group can choose to concentrate on the implementation of that guideline. When four or more groups choose the same guideline to implement and they wish to collaborate with others, they may form an action group.

In the action group, each medical group sets specific goals they plan to achieve in improving patient care based on the particular guideline(s). Each medical group shares its experiences and supporting measurement results within the action group. This sharing facilitates a collaborative learning environment. Action group learnings are also documented and shared with interested medical groups within the collaborative.

Currently, action groups may focus on one guideline or a set of guidelines such as hypertension, lipid treatment, and tobacco cessation.

Implementation Recommendations

Prior to implementation, it is important to consider current organizational infrastructure that address the following:

- System and process design

- Training and education
- Culture and the need to shift values, beliefs and behaviors of the organization

The following system changes were identified by the work group as key strategies for health care systems to incorporate in support of the implementation of this protocol.

1. Standardize tools, checklists, equipment, and practices.
2. Train all staff and physicians on the standard practices and tools to assist in adhering to those standard practices.
3. Implement the entire ventilator bundle to result in significantly better outcomes than any of the elements of the bundle implemented independently. For successful bundle implementation you need:
    - Continuous and frequent measurement and feedback on the bundle implementation (process measures)
    - Multidisciplinary approach – by involving all those who play vital roles in implementing the various components of the bundle, the need for all the roles to work together becomes imperative for successful bundle implementation
    - Reminders to staff on the various bundle components in multiple ways such as a reminder on the admission order, in patient rooms and on other rounding sheets
    - Use of the order set (containing all the bundle components) as the routine – a physician has to issue a specific order if something else is to be followed
4. Recommend an organizational approach, involving critical care expertise, regarding an appropriate standardized situational approach for determining the type of suction system used.

Implementation Tools

Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Staying Healthy

IOM Domain

Effectiveness

Safety

Identifying Information and Availability

Bibliographic Source(s)

Institute for Clinical Systems Improvement (ICSI). Prevention of ventilator-associated pneumonia. Health care protocol. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2011 Nov. 29 p. [39 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2011 Nov

Guideline Developer(s)

Institute for Clinical Systems Improvement - Nonprofit Organization

Guideline Developer Comment

Organizations participating in the Institute for Clinical Systems Improvement (ICSI): Organizations participating in the Institute for Clinical Systems Improvement (ICSI): Affiliated Community Medical Centers; Allina Medical Clinic; Aspen Medical Group; Baldwin Area Medical Center; Brown Clinic; Center for Diagnostic Imaging/Medical Scanning Consultants; CentraCare; Central Lakes Medical Clinic; Chippewa County – Montevideo Hospital & Clinic; Cuyuna Regional Medical Center; Essentia Health; Fairview Health Services; Family HealthServices Minnesota; Family Practice Medical Center; Fergus Falls Medical Clinic; Gillette Children's Specialty Healthcare; Grand Itasca Clinic and Hospital; Hamm Clinic; HealthEast Care System; HealthPartners Central Minnesota Clinics; HealthPartners Medical Group & Regions Hospital; Hennepin County Medical Center; Hennepin Faculty Associates; Howard Young Medical Center; Hudson Physicians; Hutchinson Area Health Care; Hutchinson Medical Center; Integrity Health Network; Lake Region Healthcare Corporation; Lakeview Clinic; Mankato Clinic; MAPS Medical Pain Clinics; Marshfield Clinic; Mayo Clinic; Mercy Hospital and Health Care Center; Midwest Spine Institute; Minnesota Association of Community Health Centers; Minnesota Gastroenterology; Multicare Associates; New Richmond Clinic; North Central Heart Institute; North Clinic; North Memorial Health Care; Northwest Family Physicians; Obstetrics and Gynecology Specialists; Olmsted Medical Center; Park Nicollet Health Services; Planned Parenthood Minnesota, North Dakota, South Dakota; Quello Clinic; Raiter Clinic; Rice Memorial Hospital; Ridgeview Medical Center; River Falls Medical Clinic; Riverwood Healthcare Center; South Lake Pediatrics; Southside Community Health Services; Stillwater Medical Group; University of Minnesota Physicians; Winona Health

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Guideline Committee

Respiratory Steering Committee

Composition of Group That Authored the Guideline

Work Group Members: Craig Weinert, MD (*Work Group Leader*) (Fairview Health Service); Ann Tescher, RN, PhD (Mayo Clinic) (Nursing); Stephanie Tismer, RN, ICP (HealthPartners Medical Group and Regions Hospital) (Nursing); Kimberly Boeser, PharmD (Fairview Health Services) (Pharmacy); Lori Ingalls, RRT, RCP (Mayo Clinic) (Respiratory Therapy); Sue Wiersgalla, RCP, RRT (North Memorial Medical Center) (Respiratory Therapy); Kari Retzer, RN (Institute for Clinical Systems Improvement) (Facilitator)

Financial Disclosures/Conflicts of Interest

In the interest of full disclosure, the Institute for Clinical Systems Improvement (ICSI) has adopted a policy of revealing relationships work group members have with companies that sell products or services that are relevant to this guideline topic. It is not assumed that these financial interests

will have an adverse impact on content. They are simply noted here to fully inform users of the guideline.

No work group members have potential conflicts of interest to disclose.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site .

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org ; e-mail: icsi.info@icsi.org.

Availability of Companion Documents

The following is available:

- Development and revision process for guidelines, order sets, and protocols. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2007 Jun. 5 p. Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site .

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org ; e-mail: icsi.info@icsi.org

In addition, the ICSI order set for prevention of ventilator-associated pneumonia is available in the original guideline document .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on May 31, 2012.

Copyright Statement

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